

that is acceptable to the gopher, indicate that these rodents can be successfully poisoned. While pelts of beavers and muskrats are of considerable value, gopher pelts are worth nothing, and in the Imperial Valley these animals appear to be of no use whatever.

The rodent problems in the Imperial Valley are distinct from those that present themselves elsewhere in the state. Gopher control will be a hard fight in this section, growing harder and more expensive the longer it is put off. Any successful method of control must accord with the habits and food preference of this species, which at the present time are not well understood. A thorough study of the life history of this species should be made. The facts thus obtained, combined with actual field experiments in poisoning these rodents, would save thousands of dollars that are now being wasted in well meaning but ill-advised, unorganized, and wasteful attempts at control.

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#### A BROWN MUTATION IN THE OPOSSUM (*DIDELPHIS VIRGINIANA*) WITH REMARKS UPON THE GRAY AND THE BLACK PHASES IN THIS SPECIES<sup>1</sup>

BY CARL HARTMAN

Through the courtesy of the United States Biological Survey and the United States National Museum I have been enabled to examine three brown specimens of opossums which clearly belong to the species *Didelphis virginiana*. The color of these is strikingly like the cinnamon colored mutant of the roof rat (*Rattus alexandrinus*) described by Patterson (1920) who thinks that this form may be analogous to the cinnamon mutation of the guinea pig described by Castle and Wright (1916). Like the cinnamon rat the brown opossums appeared in the wild; and since the opossum belongs to the order Marsupialia this report is not without genetic interest.

Before entering upon a detailed description of the new specimens it is necessary to recall the normal coat color of the opossum. Two phases, gray and black, have been described for the large North American opossums. In *D. marsupialis texensis* both phases are mentioned by

<sup>1</sup> Contribution No. 153, Zoological Laboratory, The University of Texas.

all authors, the black phase predominating (cf. Allen 1901, and Mearns, 1907). I have had about 20 specimens of this subspecies from San Benito, Cameron County; all of these were black.<sup>2</sup> For *D. virginiana*, however, Allen (1901) fails to mention the black phase, and one would gather from his monograph that none but the gray occurs in this species. Elliot (1901), however, had two blacks among his twelve Virginia opossums from Florida. In August, 1919, I saw a black of this species lying by the roadside near Oxford, Iowa. At Austin, Texas, the black phase of *virginiana* is found frequently. For example among the last 200 females of my records 15 are designated as "black"; but as the records were made for other than taxonomic purposes it is likely that several blacks escaped description in my notes. The percentage of blacks in central Texas is probably near ten per cent. From these facts it would appear that the black phase has received inadequate attention at the hands of mammalogists, although from the standpoint of genetics the blacks are of special significance.

The chief interest attaching to the black phase pertains to the independence of pigmentation of overhair and underfur. For it should be recalled that in grays and in blacks the underfur is alike, that is, it is white except for the black tip. The long, coarse overhair, however, is either white or black for its entire length on any given animal.<sup>3</sup> An animal is gray or black according to the color of the overhair. Some blacks have a few or even many white overhairs among the black, chiefly posteriorly; but there seems to be no intergrading series between the gray and the black phases. Dark gray specimens, for which Bangs (1898) attempted to set up a new subspecies (*D. virginiana pigra*), are often met with in this locality. No analysis of our dark grays has as yet been made, but they, too, are in a different class from the blacks.

Corresponding to these two normal phases of the opossum are the brown animals now to be described in which brown pigment has replaced black. Two specimens, skins Nos. 235543 and 235535, of the United States National Museum, Biological Survey Collection, were caught somewhere near Houstonia, Cooper County, Missouri, December, 1920, and were sent in by Dr. Chas. A. McNeill of Sedalia, Missouri, who states that according to information he has been able to gather

<sup>2</sup> It is possible that blacks only were selected for shipment and that these therefore do not represent random catches.

<sup>3</sup> The writer has among his notes a reference to a Virginia opossum having individual overhairs partly white and partly black. Such specimens must be very rare.

from animal dealers brown opossums are occasionally taken by hunters in Cooper County. The third skin examined is No. 19083 of the United States National Museum, received from Warsaw, Illinois, in 1890. The first is of the "all brown" variety, corresponding to the black phase; that is, all of the overhairs are brown except about a dozen white ones near the tail. It is darker than the other two, possibly approaching chocolate. The underfur is brown-tipped and brown pigment is seen in the skin of the snout and the scales on the proximal 40 mm. of the tail. The ears seem to be black. The other two specimens differ from the first in having the overhair white; in other words they correspond to the normal grays. All the specimens are large and have the extremely short tails characteristic of *D. virginiana*.

To summarize, then, four varieties of *D. virginiana* seem clearly differentiated:

1. The gray phase, with underfur black-tipped, overhair all white.
2. The black phase, with underfur also black-tipped, overhair altogether or for the most part black.

3 and 4. Like 1 and 2, with brown pigment replacing the black.

For an account of the occurrence of the brown mutation among mammals the reader is referred to Castle's book "Genetics and Eugenics" (1920) and to the several articles listed below. Recently Miller (1921) in this journal published a description of a brown mole, an insectivore; and with the present record the mutation is extended to the Marsupialia. This raises the question whether or not there is a very general distribution of the same factors involved in the development of coat color within the class Mammalia.

ADDENDUM.—Since sending the preceding article to the editor of the Journal the writer has been fortunate enough to secure from Doctor McNeill three additional specimens of the cinnamon opossum. They reached Austin, Texas, alive and in excellent condition from Sedalia, Missouri, where Doctor McNeill purchased them. Nothing else is known concerning their history. Of these three one enormous male and one two-year old female have white overhair; the third specimen is a yearling female without any white overhair whatever, that is, it is solid cinnamon. The feet and the base of the tail are brown. The ears are dark except for the unpigmented tip often seen in *virginiana* and *marsupialis*; but the pigmentation is light as compared with the black ears of the gray phase and tends toward brown, especially in the last mentioned individual. In this the ears are the lightest, and distinctly and unmistakably brown.

The iris of the eye was also examined in the three mutants as well as in the normal controls (grays). The iris is generally invisible, but in the bright sunlight it appears as a narrow marginal band. In the gray phase the iris is deeply pigmented, almost black; in the cinnamon mutants the iris is light, blending from the very light inner margin to a distinct brown at the periphery where it disappears under the eyelid.

All pigmented areas of the McNeill mutants, therefore (hair, scales of tail, ears and iris), have the brown color.

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